



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/716,785	11/19/2003	Wu-Song Huang	FIS920030377US1	6138
32074	7590	01/27/2006	EXAMINER	
INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 300-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533			LEE, SIN J	
			ART UNIT	PAPER NUMBER
			1752	
DATE MAILED: 01/27/2006				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/716,785

Applicant(s)

HUANG ET AL.

Examiner

Sin J. Lee

Art Unit

1752

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 November 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7-19 and 21-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-19, 21-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

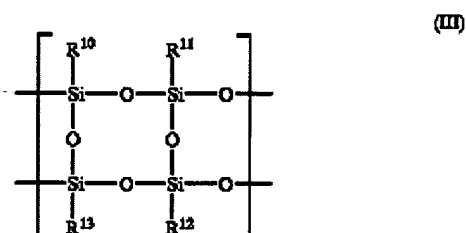
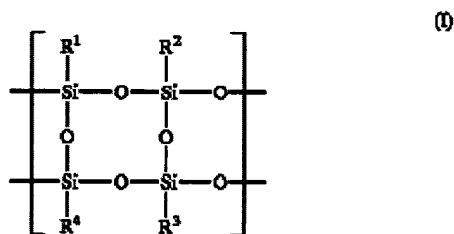
- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

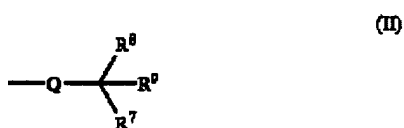
Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 1-5, 7-19, 21-27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sooriyakumaran et al (US 2002/0081520 A1) in view of Bucchignano et al (6,037,097).

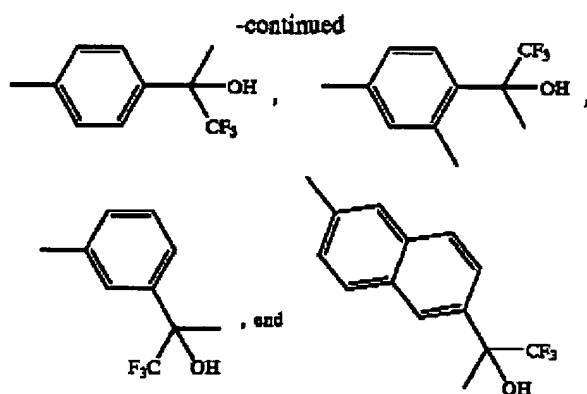
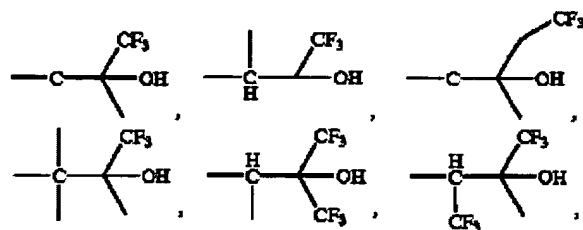
Sooriyakumaran teaches ([0048], [0044], [0045]) a *fluorocarbinol* functionalized *silsesquioxane* copolymer comprised of structure (I) monomer units and monomer units having structure (III):



In the structure (I), R¹-R⁴ are independently substituents having following structure (II):



, and Sooriyakumaran teaches ([0047]) following examples for the structure (II):



Sooriyakumaran teaches that in the structure (III), at least one of R¹⁰⁻¹³ is an acid-cleavable moiety (see [0049]). Sooriyakumaran furthermore teaches (see [0050]) that suitable acid-cleavable functionality includes ethers of the formula –OR¹⁶, in which R¹⁶ is an acid-cleavable functionality. Sooriyakumaran also teaches a photoacid generator as the second component of his resist composition (see [0056]).

Bucchignano teaches (col.2, lines 21-29, lines 35-53) that by using a cyclic aliphatic ketal substituent as an acid labile protecting group for an aqueous base soluble copolymer, one can obtain a chemically amplified resist that provides improved resist coating shelf life and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely affecting the chemical nature of the aqueous base soluble copolymer. Bucchignano teaches a methoxycyclohexanyl group as a highly preferred

Art Unit: 1752

example for the unsubstituted cyclic aliphatic ketals (see col.4, lines 37-50).

Bucchignano also teaches (col.4, lines 51-58) that hydrogen of the cycloaliphatic portions of the ketal substituent can be substituted with hydrophobic groups such as –CF₃, –CHF₂, –CH₂F, –CCl₃, –CHCl₂, –CH₂Cl, and –Si(CH₃)₃.

3. In view of Bucchignano's teaching, it would have been obvious to one of ordinary skill in the art to use –OR¹⁶ group as Sooriyakumaran's acid-cleavable group in structure (III), in which R¹⁶ represents either **methoxycyclohexanyl group** (the –OR¹⁶ group, in which R¹⁶ is methoxycyclohexanyl group, teaches present first formula of claim 1) or methoxycyclohexanyl group substituted with CF₃, –CHF₂, –CH₂F, –CCl₃, –CHCl₂, –CH₂Cl, or –Si(CH₃)₃, *in order to obtain a chemically amplified resist that provides improved resist coating shelf life and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely affecting the chemical nature of the aqueous base soluble copolymer as taught by Bucchignano*. Therefore, Sooriyakumaran in view of Bucchignano would render obvious present inventions of claims 1-5 and 7-10: **because present specification (pg.13, lines 19-32) also lists “methoxycyclohexanyl” group as one of preferred examples for cyclic ketal protecting groups that satisfy the first formula of claim 1**, it follows that the –OR¹⁶ group, in which R¹⁶ represents a methoxycyclohexanyl group, used as Sooriyakumaran's acid-cleavable group would inherently have a low activation energy less than about 20 kcal/mol for acid-catalyzed cleaving, and the same acid-cleavable group would inherently be cleavable at room temperature as presently recited.

With respect to present claim 11, Sooriyakumaran teaches ([0055]) that his copolymer generally has an average Mw in the range of 1,000 to 5,000. Therefore, Sooriyakumaran in view of Bucchignano would render obvious present invention of claim 11.

Sooriyakumaran teaches ([0075]) a process for generating a resist image on a substrate which comprises the steps of: (a) coating a substrate with a film comprising his resist composition; (b) imagewise exposing the film to radiation; and (c) developing the image. Sooriyakumaran teaches ([0080]) that the pattern from the resist structure may then be transferred to the material of the underlying substrate by etching. Sooriyakumaran also teaches a post-exposure baking step (see [109]). Therefore, Sooriyakumaran in view of Bucchignano would render obvious present inventions of claims 14-19, 21-24 and 30.

With respect to present claim 27, Sooriyakumaran teaches that a bilayer substrate may be employed in which his resist composition forms an upper resist layer on top of a bilayer substrate comprised of a base layer and underlayer that lies between the upper resist layer and the base layer. Thus, Sooriyakumaran in view of Bucchignano would render obvious present invention of claim 27.

With respect to present claims 12, 13, 25, and 26, in his Example 3, Sooriyakumaran teaches partial protection of poly(2-hydroxy-3,3,3-trifluoropropylsilanesquioxane) with acid-cleavable trimethylsilyl group. Based on Bucchignano's teaching (i.e., the use of a cyclic aliphatic ketal substituent as an acid labile protecting group for an aqueous base soluble copolymer provides a chemically

Art Unit: 1752

amplified resist, which has improved resist coating shelf life and with little or no vacuum effects on use and which prevents air-borne contaminants from adversely affecting the chemical nature of the aqueous base soluble copolymer), it would have been obvious to one of ordinary skill in the art to partially protect Sooriyakumaran's poly(2-hydroxy-3,3,3-trifluoropropylsilsesquioxane) with acid-cleavable cyclic aliphatic ketal substituent such as methoxycyclohexanyl group in order to obtain a chemically amplified resist, which has improved resist coating shelf life and with little or no vacuum effects on use and which prevents air-borne contaminants from adversely affecting the chemical nature of the aqueous base soluble copolymer. Such polymer comprises present combination of monomeric units (II) and (III); *in the formula (III)*, X would be a methylene group, R^3 would be a H atom, R^4 would be $-CF_3$ (a fluorinated alkyl group), q would be 0, and R^6 would be $-OH$ (a solubility promoting group). In the formula (II), X would be a methylene group, R^3 would be a H atom, R^4 would be $-CF_3$ (a fluorinated alkyl group), q would be 0, and R^5 would be methoxycyclohexanyl oxy group (present solubility inhibiting cyclic ketal group). Also, such polymer comprises present combination of monomeric units (II) and (V); in the formula (V), X would be a methylene group, one R^3 would be a H atom, another R^3 would be $-CF_3$ (a halogenated alkyl group), q would be 0, and R^6 would be $-OH$ (a solubility promoting group). Therefore, Sooriyakumaran in view of Bucchignano would render obvious present inventions of claims 12, 13, 25, and 26.

4. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sooriyakumaran et al (US 2002/0081520 A1) in view of Bucchignano et al

(6,037,097) as applied to claim 27 above, and further in view of Khojasteh et al (US 2002/0058204 A1).

Sooriyakumaran in view of Bucchignano is discussed above in Paragraph 4. As discussed above, Sooriyakumaran teaches that a bilayer substrate may be employed in which his resist composition forms an upper resist layer on top of a bilayer substrate comprised of a base layer and underlayer that lies between the upper resist layer and the base layer. Sooriyakumaran does not teach present underlayer composition of claim 28. Khojasteh teaches ([0009]-[0021]) an underlayer composition comprising (a) a polymer containing (i) cyclic ether moieties, (ii) saturated polycyclic moieties, and (iii) aromatic moieties, and (b) an acid generator, or an underlayer composition comprising (a) a polymer containing (i) saturated polycyclic moieties, and (ii) aromatic moieties, (b) an acid generator, and (c) a crosslinker. Khojasteh teaches that use of such an underlayer composition provide underlayers having outstanding optical, mechanical and etch selectivity properties ([0008]). In view of Khojasteh's teaching, it would have been obvious to one of ordinary skill in the art to use Khojasteh's underlayer composition for Sooriyakumaran's underlayer in order to obtain underlayer having outstanding optical, mechanical and etch selectivity properties as taught by Khojasteh. Khojasteh also teaches ([0058]) that the polymer of the underlayer composition preferably contains a fluorine components such as pentafluoroaryl group and trifluoromethyl group. Therefore, Sooriyakumaran in view of Khojasteh and further in view of Khojasteh would render obvious present inventions of claims 28 and 29.

Response to Arguments

5. Applicants argue that Sooriyakumaran, either alone or in view of Bucchignano, fails to teach or suggest an acid-labile moiety having low-activation energy less than about 20 kcal/mol for acid-catalyzed cleaving, and wherein the acid-labile moiety is cleavable at room temperature. The Examiner disagrees. As explained above, Sooriyakumaran in view of Bucchignano renders it obvious for one of ordinary skill in the art to use $-OR^{16}$ group, in which R^{16} represents a methoxycyclohexanyl group, as Sooriyakumaran's acid-cleavable group in structure (III). **Because present specification (pg.13, lines 19-32) also lists "*methoxycyclohexanyl*" group as one of preferred examples for cyclic ketal protecting groups that satisfy the first formula of claim 1**, it follows that the $-OR^{16}$ group, in which R^{16} represents a methoxycyclohexanyl group, used as Sooriyakumaran's acid-cleavable group would inherently have a low activation energy less than about 20 kcal/mol for acid-catalyzed cleaving, and the same acid-cleavable group would inherently be cleavable at room temperature as presently recited.

Applicants also argue that there is no motivation to combine the teachings of Sooriyakumaran with the teachings of Bucchignano to arrive at the present invention. However, the Examiner already established a proper motivation to combine the teachings of Sooriyakumaran with the teaching of Bucchignano. That is, Bucchignano (which also teaches a lithographic process) teaches that by using a cyclic aliphatic ketal substituent (such as methoxycyclohexanyl group) as an acid labile protecting group for an aqueous base soluble copolymer (with respect to the aqueous base soluble copolymer, Bucchignano states in col.2, lines 56-59 that the aqueous base soluble

polymer or copolymer contains a polymer backbone including but not limited to: polyolefins, polyolefin sulfones, polyketones, polyethers and the like), one can obtain a chemically amplified resist that provides *improved resist coating shelf life* and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely effecting the chemical nature of the aqueous base soluble copolymer. Therefore, based on the teachings of Bucchignano, one skilled in the art would have been motivated to use $-OR^{16}$ group, in which R^{16} represents a methoxycyclohexanyl group, as Sooriyakumaran's acid-cleavable group in structure (III) so as to obtain a chemically amplified resist that provides *improved resist coating shelf life* and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely effecting the chemical nature of the aqueous base soluble copolymer.

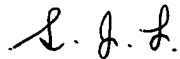
For the reasons stated above, it is still the Examiner's position that Sooriyakumaran in view of Bucchignano render obvious present inventions, especially in the absence of unexpected superior results of present invention.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is 571-272-1333. The examiner can normally be reached on Monday-Friday from 9:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly, can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is **571-273-8300**.

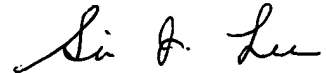
Art Unit: 1752

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Lee

January 23, 2006



SIN LEE
PRIMARY EXAMINER